

electroluminescent diodes or voltmeter dial), and a female jack socket is placed under the handle and links the firearm to the video system (see FIG. 3) through a connection cable (not represented). Preferably, the visualization organ 42 is composed of two groups of three electroluminescent diodes placed symmetrically in relation to the gunsight of the firearm, and also carried by the back part 43; the three electroluminescent diodes of each group being for example in the colors red, green, and yellow, respectively. To each color, a determined pressure amplitude is associated. A diode of a determined color thus lights up when the pressure exercised on the trigger exceeds predetermined thresholds which can be adjusted, in particular, according to the type of simulated firearm.

In order to house the laser beam emitter and the amplifier of the piezoelectric sensor, as one is limited in height by the target system, one can find the necessary space by reducing the width of the compartments 39 and 40 while respecting the same balance of masses as in the real firearm by means of an adequate distribution of ballasts. The global mass of the simulation firearm must be identical with that of the real firearm.

Upon reading what has been said so far, one concludes easily that the invention reaches the goals it set out to fulfil.

It allows in particular a multi-sense multiple involvement which is synchronized, simultaneous and advantageously proportional. It allows a check in real time of the exercised pressure and a training of the marksman's tactile sensitivity. It is compatible with numerous shooting disciplines and is not limited by special firearm types. It can easily be adapted to a shooting simulation system.

It must be clear, however, that the invention is not limited to the sole examples of realization explicitly described, in particular in relation to FIGS. 1 to 8.

In a variant, which is not represented, it is in particular possible to adapt the process according to the invention to a hunting firearm, even a military firearm, which includes an aiming telescope. The visualization organ, for example of the type including electroluminescent diode bars, can be integrated in the telescope or placed in front of it.

What is claimed is:

1. Process for training in real time a tactile perception of a marksman, in particular of a sport marksman, during the firing of a shot, said marksman exercising a pressure on a trigger of a real or simulation firearm and said pressure triggering the shot when it crosses a predetermined threshold, said process comprising at least the following steps:

- (i) measuring in real time the pressure exercised on said trigger by a finger of said marksman;
- (ii) converting said measured pressure into electric signals representing an instantaneous amplitude of a pressure vector;
- (iii) transforming in real time said electric signals into signals perceptible by a sense of the marksman other than a tactile perception so that the marksman can in real time follow the variation of the pressure exercised on said trigger until the departure of said shot in simultaneity and in synchronism with a tactile perception perceived by said finger.

2. Process according to claim 1, wherein said sense other than the tactile perception is the sense of sight and said step of transforming the electric signals consists in transforming said electric signals, obtained during the conversion step, into light signals representing, proportionately continuously or by moderate intervals, variations of amplitude of the pressure exercised on said trigger.

3. Process according to claim 1, wherein said sense other than the tactile perception is the sense of hearing and said step of transforming the electric signals consists in transforming said electric signals, obtained during the conversion step, into audio signals whose intensity represents, proportionately continuously or by moderate intervals, variations of amplitude of the pressure exercised on said trigger.

4. Device for training in real time a tactile perception of a marksman, in particular of a sport marksman, during the firing of a shot, said marksman exercising a pressure on a trigger of a real or simulation firearm and said pressure triggering the shot when it crosses a predetermined threshold, wherein said device includes

- (i) a pressure sensor for measuring in real time the pressure exercised by the marksman's finger on said trigger, comprising (a) a hydraulic circuit including an elastic pressure-receiving capsule filled with liquid which receives the pressure exercised by the marksman, (b) a fine ductile tube which is not elastic, and (c) a manometer to which this pressure is transmitted through said liquid,
- (ii) a serial circuit for converting the measured pressure into electric signals comprising (a) an electric feeder source and (b) a rheostat, said manometer being mechanically coupled to a cursor hand of said rheostat and making an impedance of said rheostat vary, in such a way as to generate electric signals representing the instantaneous pressure exercised on said trigger, and
- (iii) an organ measuring the instantaneous amplitude of a current in said serial circuit, in such a way as to transform in real time said electric signals representing the instantaneous pressure exercised on said trigger into signals perceptible by a sense of the marksman other than a tactile perception.

5. Device according to claim 4, wherein said organ transforms said electric signals into light signals and displays these light signals, said organ comprising a voltmeter hand or band, a set of electroluminescent diodes or a video display, so that said light signals are displayed in a continuously variable way in order to represent the instantaneous variation of said exercised pressure, or by moderate intervals when the pressure crosses predetermined thresholds.

6. Device according to claim 5, wherein said firearm is a simulation firearm and said display is a video display, said device being furthermore equipped with means for generating a laser bundle or similar towards a target display and with interface circuits which receive said electric signals, said interface circuits being composed of circuits for handling signals according to a recorded program,

said recorded program including parameterizable rules taking into account predetermined disciplines of shooting and the calibre of the simulated firearm, and controlling at least (i) generation of control signals of said display for setting to scale said target in relation to a distance target-firearm, (ii) display of simulated impacts on said target whose sizes vary in relation to said calibre, (iii) a specific timing for each of said disciplines, (iv) display and a chronological numbering of the impacts, (v) a total numbering of impacts, and (vi) corrections made by said marksman during aiming.

7. Device according to claim 4, wherein said organ transforms said electric signals into audible signals in the acoustic frequency band and comprises at least one electroacoustic transducer disposed in an ear protection of sound-protection ear muffs carried by said marksman, in such a way as to emit said audible signals in a continuously variable way to represent the instantaneous variation of said

exercised pressure, or by moderate intervals when the pressure crosses predetermined thresholds.

8. Device according to claim 4, wherein said firearm is a simulation firearm and said display is a video display, said device being furthermore equipped with means for generating a laser bundle or similar towards a target display and with interface circuits which receive said electric signals, said interface circuits being composed of circuits for handling signals according to a recorded program,

said recorded program including parameterizable rules taking into account predetermined disciplines of shooting and the calibre of the simulated firearm, and controlling at least (i) generation of control signals of said display for setting to scale said target in relation to a distance target-firearm, (ii) display of simulated impacts on said target whose sizes vary in relation to said calibre, (iii) a specific timing for each of said disciplines, (iv) display and a chronological numbering of the impacts, (v) a total numbering of impacts, and (vi) corrections made by said marksman during aiming.

9. Device according to claim 8, wherein said video display includes a central zone comprising

(i) a visual display representing in a continuously variable way, according to a vertical axis of said target, the instantaneous vector of the pressure exercised on said trigger, said visual indication increasing from top to bottom and reaching the escape pressure at the center of the target, and

(ii) a display zone representing a transverse acceleration vector ( $\gamma$ ) of said firearm in the moment of the shot from an impact called "laser" towards an impact called "projectile" which takes into account the effect, on a projectile, of an impulse transverse to its trajectory at the time of the shot, by measuring the segment covered on said pending target of predetermined time lapses that frame this shot,

said displays being under the control of the recorded program in said interface circuits.

10. Device according to claim 8, wherein said video display includes a central zone comprising

(i) a visual display representing in a continuously variable way, according to a vertical axis of said target, the instantaneous vector of the pressure exercised on said trigger, said visual indication increasing from top to bottom and reaching the escape pressure at the center of the target, and

(ii) a display zone representing a transverse acceleration vector ( $\gamma$ ) of said firearm in the moment of the shot from an impact called "laser" towards an impact called "projectile" which takes into account the effect, on a projectile, of an impulse transverse to its trajectory at the time of the shot, by measuring the segment covered on said pending target of predetermined time lapses that frame this shot,

said displays being under the control of the recorded program in said interface circuits.

11. Device according to claim 8, wherein said video display includes a central zone comprising

(i) a visual display representing in a continuously variable way, according to a vertical axis of said target, the instantaneous vector of the pressure exercised on said trigger, said visual indication increasing from top to bottom and reaching the escape pressure at the center of the target, and

(ii) a display zone representing a transverse acceleration vector ( $\gamma$ ) of said firearm in the moment of the shot

from an impact called "laser" towards an impact called "projectile" which takes into account the effect, on a projectile, of an impulse transverse to its trajectory at the time of the shot, by measuring the segment covered on said pending target of predetermined time lapses that frame this shot,

said displays being under the control of the recorded program in said interface circuits.

12. Device according to claim 8, wherein said video display includes a central zone comprising

(i) a visual display representing in a continuously variable way, according to a vertical axis of said target, the instantaneous vector of the pressure exercised on said trigger, said visual indication increasing from top to bottom and reaching the escape pressure at the center of the target, and

(ii) a display zone representing a transverse acceleration vector ( $\gamma$ ) of said firearm in the moment of the shot from an impact called "laser" towards an impact called "projectile" which takes into account the effect, on a projectile, of an impulse transverse to its trajectory at the time of the shot, by measuring the segment covered on said pending target of predetermined time lapses that frame this shot,

said displays being under the control of the recorded program in said interface circuits.

13. Device for training in real time a tactile perception of a marksman, in particular of a sport marksman, during the firing of a shot, said marksman exercising a pressure on a trigger of a real or simulation firearm and said pressure triggering the shot when it crosses a predetermined threshold, wherein said device includes

(i) a pressure sensor for measuring the pressure exercised by the marksman's finger on said trigger, comprising a rack actuated by said trigger and driving a set of gears,

(ii) a serial circuit comprising (a) an electric feeder source and (b) a rotatable rheostat driven by said set of gears, in such a way as to generate electric signals representing the instantaneous pressure exercised on said trigger, and

(iii) an organ measuring an instantaneous amplitude of a current in said serial circuit, in such a way as to transform in real time said electric signals representing the instantaneous pressure exercised on said trigger into signals perceptible by a sense of the marksman other than a tactile perception.

14. Device according to claim 13, wherein said organ transforms said electric signals into light signals and displays these light signals, said organ comprising a voltmeter hand or band, a set of electroluminescent diodes or a video display, so that said light signals are displayed in a continuously variable way in order to represent the instantaneous variation of said exercised pressure, or by moderate intervals when the pressure crosses predetermined thresholds.

15. Device according to claim 13, wherein said organ transforms said electric signals into light signals and displays these light signals, said organ comprising a voltmeter hand or band, a set of electroluminescent diodes or a video display, so that said light signals are displayed in a continuously variable way in order to represent the instantaneous variation of said exercised pressure, or by moderate intervals when the pressure crosses predetermined thresholds.

16. Device according to claim 13, wherein said organ transforms said electric signals into audible signals in the acoustic frequency band and comprises at least one electroacoustic transducer disposed in an ear protection of

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sound-protection ear muffs carried by said marksman, in such a way as to emit said audible signals in a continuously variable way to represent the instantaneous variation of said exercised pressure, or by moderate intervals when the pressure crosses predetermined thresholds.

17. Device according to claim 13, wherein said firearm is a simulation firearm and said display is a video display, said device being furthermore equipped with means for generating a laser bundle or similar towards a target display and with interface circuits which receive said electric signals, said interface circuits being composed of circuits for handling signals according to a recorded program,

said recorded program including parameterizable rules taking into account predetermined disciplines of shooting and the calibre of the simulated firearm, and controlling at least (i) generation of control signals of said display for setting to scale said target in relation to a distance target-firearm, (ii) display of simulated impacts on said target whose sizes vary in relation to said calibre, (iii) a specific timing for each of said disciplines, (iv) display and a chronological numbering of the impacts, (v) a total numbering of impacts, and (vi) corrections made by said marksman during aiming.

18. Device for training in real time a tactile perception of a marksman, in particular of a sport marksman, during the firing of a shot, said marksman exercising a pressure on a trigger of a real or simulation firearm and said pressure triggering the shot when it crosses a predetermined threshold, wherein said device includes

(i) a pressure or force sensor with piezoelectric effect placed in a glove finger or fixed on the trigger for measuring in real time the pressure exercised by the finger of said marksman on said trigger, said sensor with piezoelectric effect generating electric signals whose amplitude is proportional to the exercised pressure,

(ii) an electronic amplifier to which said electric signals whose amplitude is proportional to the exercised pressure are transmitted, an exit of said electronic amplifier generating electric signals representing the instantaneous pressure exercised on said trigger, and

(iii) an organ measuring an instantaneous amplitude of a current at the exit of said electronic amplifier, in such a way as to transform in real time said electric signals representing the instantaneous pressure exercised on said trigger into signals perceptible by a sense of the marksman other than a tactile perception.

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19. Device according to claim 18, wherein said organ transforms said electric signals into audible signals in the acoustic frequency band and comprises at least one electroacoustic transducer disposed in an ear protection of sound-protection ear muffs carried by said marksman, in such a way as to emit said audible signals in a continuously variable way to represent the instantaneous variation of said exercised pressure, or by moderate intervals when the pressure crosses predetermined thresholds.

20. Device according to claim 18, wherein said firearm is a simulation firearm and said display is a video display, said device being furthermore equipped with means for generating a laser bundle or similar towards a target display and with interface circuits which receive said electric signals, said interface circuits being composed of circuits for handling signals according to a recorded program,

said recorded program including parameterizable rules taking into account predetermined disciplines of shooting and the calibre of the simulated firearm, and controlling at least (i) generation of control signals of said display for setting to scale said target in relation to a distance target-firearm, (ii) display of simulated impacts on said target whose sizes vary in relation to said calibre, (iii) a specific timing for each of said disciplines, (iv) display and a chronological numbering of the impacts, (v) a total numbering of impacts, and (vi) corrections made by said marksman during aiming.

21. Device for training in real time a tactile perception of a marksman, in particular of a sport marksman, during the firing of a shot, said marksman exercising a pressure on a trigger of a real or simulation firearm and said pressure triggering the shot when it crosses a predetermined threshold, wherein said device includes

(i) a pressure sensor for measuring in real time the pressure exercised by the marksman's finger on said trigger,

(ii) a serial circuit for converting the measured pressure into electric signals representing the instantaneous pressure exercised on said trigger, and

(iii) an organ measuring the instantaneous amplitude of a current in said serial circuit, in such a way as to transform in real time said electric signals representing the instantaneous pressure exercised on said trigger into signals perceptible by a sense of the marksman other than a tactile perception.

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